

**State of Michigan
Draft Domestic Action Plan (DAP) for
Lake Erie**

Purpose

Michigan's Domestic Action Plan (DAP) is a guiding document towards achieving a healthier Lake Erie ecosystem. Michigan's DAP affirms actions towards: 1) commitments under the Western Basin of Lake Erie Collaborative Agreement (Collaborative Agreement); 2) meeting the nutrient-related ecosystem goals for Lake Erie under [Annex 4](#) (Nutrients) of the [Great Lakes Water Quality Agreement \(GLWQA\)](#); and, 3) process and tactics for Michigan to implement as a jurisdiction and in collaboration with local municipalities, nongovernmental organizations (NGOs), other stakeholders, as well as the states of Ohio, Indiana, Pennsylvania, New York, and the Province of Ontario.

Ecosystem goals for Lake Erie include reducing harmful algal blooms (HABs) in the western basin, eliminating the hypoxic zone in the central basin, and reducing *Cladophora* growth in the eastern basin. The DAP lays out specific objectives for the State of Michigan; actions to be taken or supported by the Michigan Departments of Agriculture and Rural Development (MDARD), Environmental Quality (MDEQ) and Natural Resources (MDNR) (i.e., Quality of Life [QOL] agencies); program, policy and research gaps; and, an adaptive implementation strategy. Together, these provide a focus for allocating existing resources and helping to identify resource gaps. Finally, this DAP describes how Michigan will measure, track and report progress toward meeting its objectives.

Background

Lake Erie has experienced many water quality problems over the past 50 years, including nutrient enrichment. In the 1960s, the lake was declared "dead" due to high nutrient loadings from point and nonpoint sources (NPS). Excessive algae fouled beaches and consumed life-supporting oxygen from the lake. Major pollution control efforts targeting municipal and industrial point sources and pollution from land use activities (i.e., NPS) in the 1970s greatly improved the water quality. Lake Erie recovered and was soon recognized as a tremendous walleye and perch fishery and recreational resource for boating, swimming, birding, and waterfowl hunting. Lake Erie coastal marshes and wetland habitats provide regionally significant habitat for sensitive, threatened and endangered fish, wildlife, and plant species.

Environmental conditions began to change again in the late 1980s as invasive zebra and quagga (*Dreissenid*) mussels established in Lake Erie. Zebra and quagga mussels have changed the lake ecosystem in many ways that are not well understood, including shifting how nutrients cycle in the water column and sediment, by feeding selectively on green algae and thereby increasing local concentrations of cyanobacteria (i.e., blue-green algae), and by increasing water clarity with high densities and high rates of filtration. During the same time period, other changes occurred on the landscape that affect nutrient delivery and loading rates, such as the evolution of farming practices and changes in storm frequency and intensity. All of these changes resulted in persistent and intense cyanobacteria blooms occurring on a regular basis in the Western Lake Erie Basin (WLEB) starting in the 1990s, which contributed to redevelopment of a hypoxic zone in the central basin, and nuisance *Cladophora* growth in the eastern basin. In August 2014, the Toledo, Ohio, drinking water supply was overwhelmed with cyanotoxins and had to stop supplying drinking water for parts of three days. This resulted in a sense of urgency to take action to correct the problems Lake Erie is facing.

Two key agreements were initiated in 2015 towards commitments to progress in Lake Erie. One was led by the states and province and the other was federally led by the U.S. and Canada. In June 2015, Governor Rick Snyder signed the Collaborative Agreement with Premier Kathleen Wynne of Ontario and Lieutenant Governor Mary Taylor of Ohio. This Collaborative Agreement establishes an initiative that has a defined goal, establishes specific implementation plans, and is measured against expected results. Meanwhile, the Parties to the GLWQA (i.e., the governments of Canada and the United States [U.S.]), working with state and local agencies, scientists and NGOs, developed a framework for action under Annex 4 (Nutrients) of the GLWQA. Key to progress under Annex 4 is the establishment of specific ecosystem goals, a collaborative process for identifying needed actions and tracking their implementation, and a framework for measuring water quality improvement and progress toward meeting the ecosystem goals. The next step is for each jurisdiction to develop a DAP (Canada and Ontario will have one plan) that when taken together will outline the actions, priorities, and gaps for meeting the overall ecosystem goals for Lake Erie.

The MDEQ published its implementation plan for the Agreement in January 2016. Since that time, the QOL agencies have worked to advance and expand implementation approaches. This DAP builds on and incorporates those efforts into one collaborative DAP for Michigan.

In November 2016, MDEQ included the WLEB on the 2016 303(d), Impaired Waters list submitted to the U.S. Environmental Protection Agency (U.S. EPA). This impairment listing is based on repeated, widespread and persistent cyanobacteria blooms described above. The conditions in Lake Erie are documented by monitoring data along Michigan's shoreline and through satellite imagery. The blooms in Michigan's waters of the WLEB were determined to be excessive/nuisance conditions indicating ecological imbalance. Given the complexity of the problem and the multijurisdictional requirements for solving it, MDEQ is convinced that the path toward resolution is through the Collaborative Agreement and Annex 4 DAP, and is fully committed to these processes.

Goals

The following ecosystem goals for Lake Erie have been established through the Annex 4 process. Michigan's DAP is focused on achieving these goals which are inclusive of the goals of the Collaborative Agreement:

- **Minimize the extent of hypoxic zones in the waters of the central basin of Lake Erie.** Reduce total phosphorus (TP) entering the western and central basins of Lake Erie by 40 percent - from the U.S. and from Canada – to achieve an annual load of 6,000 metric tons (MT) to the central basin. This amounts to a reduction from the U.S. and Canada of 3,316 MT and 212 MT, respectively.
- **Maintain algal species consistent with healthy aquatic ecosystems in the nearshore waters of the western and central basins of Lake Erie. For the western basin this means conditions that are similar to or smaller than bloom conditions observed in mid-year blooms in 2004 or 2012 90 percent of the time.** Reduce spring total and soluble reactive phosphorus (SRP) loads from the following watersheds where algae is a localized problem by 40 percent: in Canada, the Thames River and Leamington tributaries; and in the U.S., the Maumee, River Raisin, Portage River, Toussaint Creek, Sandusky River, and Huron River (Ohio).

- **Maintain cyanobacteria biomass at levels that do not produce concentrations of toxins that pose a threat to human or ecosystem health in the waters of the western basin of Lake Erie.** Reduce spring total and SRP loads from the Maumee River in the U.S. by 40 percent.

Objectives

Following are the specific objectives of this DAP to ensure Michigan fully contributes to meeting the larger ecosystem goals established under Annex 4 and its commitment under the Collaborative Agreement. Based on 2008 loads, reduce the following by 20 percent by 2020, and 40 percent by 2025:

- TP loads from the Detroit River.
- Spring TP loads from the River Raisin.
- Spring SRP loads from the River Raisin.
- Spring TP and SRP contributions from the Maumee River. This objective will be refined for Michigan's waters of the Maumee River following results of watershed monitoring conducted by Michigan, Ohio, and Indiana.

Actions Moving Forward

Michigan has been proactive and successful in reducing phosphorus (P) loads to Lake Erie, but the work is not complete. Michigan remains committed to addressing current problems by focusing on the following general actions in the future. Details of the work plan, including timelines and milestones, are included in Appendix 1.

1. Maintain the reductions achieved in the Great Lakes Water Authority (GLWA) discharge as a result of the tightened permit limits.
2. Achieve reductions in P discharged from the Wayne County Downriver Wastewater Treatment Facility (DWTF), and continue reductions at Ypsilanti Community Utility Authority Wastewater Treatment Plant (YCUA WWTP).
3. Identify priority areas in Michigan's portion of the Maumee River Watershed for P reductions. Identify and implement priority actions to reduce P loads from Michigan's portion of the Maumee River Watershed.
4. Support and invest in research to better understand the causes of HABs, including invasive mussels and SRP (urban and rural sources) and how these factors increase/decrease HAB events.
5. Utilize research and field demonstrations to identify the suite of BMPs that work collectively to reduce both TP and SRP at the field implementation level.
6. Implement P control actions in the River Raisin Watershed to achieve the target load reductions.
7. Maintain and expand partnerships to provide valuable technical and financial assistance to farmers. Maintain an increased level of Conservation District (CD) Michigan Agriculture Environmental Assurance Program (MAEAP) technical assistance levels

through 2017 and beyond.

8. Increase and maintain MAEAP practice implementation for long term water quality improvement.
9. Improve and increase outreach to the public and farmers to promote understanding of the WLEB and good conservation practices by initiating new targeted outreach campaigns, workshops, field demonstrations and information sharing.
10. Promote wetland restoration and land management to reduce P loading.

In addition to actions focused on in this plan, we recognize that there are other items that should be addressed and are currently beyond the scope of the DAP because they will require additional legislative or policy work at a statewide level. They are listed here as items to consider to comprehensively address P loading and its negative impact. While these actions will not be tracked specifically as they relate to implementation of the DAP, the following recommendations, should they be approved by legislature, will contribute in a noteworthy way to the goals of this DAP.

- Develop and implement a uniform statewide sanitary code that is flexible and provides standards for site suitability based on risk, pass legislation establishing a uniform statewide sanitary code.
- Evaluate and implement necessary changes to laws, including state and local land-use statutes as well as the Michigan Drain Code, to create a more integrated, watershed-based system for managing water at the landscape level and achieving water quantity and quality outcomes.

Measuring Progress

The Annex 4 process determined 2008 as the base year for loads from which to measure progress. The Collaborative Agreement calls for an aspirational goal of a 20 percent reduction by 2020 and a goal of a 40 percent reduction by 2025. Michigan is working with the other states and the province to identify and agree upon basin wide metrics to measure and monitor success.

The QOL agencies will create an online presence to track performance against the 40 percent reduction goal. Michigan will continue to track the Detroit River and Raisin River progress on nutrient reductions. For the Detroit River, reductions will be calculated primarily using the GLWA and Wayne County discharge monitoring. For the Raisin River, reductions will be tracked using the monitoring data at the USGS gauging station and the Monroe WWTF discharge monitoring. Michigan will also develop a long term monitoring strategy for the Maumee River tributaries (i.e., Bean Creek and St. Joseph River) as appropriate for its contribution to overall P loads from Michigan's portions of the Maumee River Watershed.

Metrics to Track Progress towards the Objectives

Michigan will track progress toward meeting these objectives by measuring changes to in-stream P concentrations and load reduction measurements compared to 2008 values.

Point Sources

- National Pollution Discharge Elimination System (NPDES) Permits for four largest municipal wastewater treatment plants (WWTPs) to include reduced TP concentration limits. These WWTPs include the GLWA Detroit Wastewater Resource Recovery Facility (WRRF), the DWTF, the YCUA WWTP, and the Monroe Metro Wastewater Treatment Facility (WWTF).
- Permit limits consistently achieved at the largest WWTPs; no significant noncompliance
- Continue to remove untreated Combined Sewer Overflows (CSOs).
- Continue to implement:
 - Municipal Separate Storm Sewer Systems programs
 - Concentrated Animal Feeding Operation (CAFO) permits
 - Biosolids permits.

Nonpoint Sources

- The River Raisin Watershed and Michigan's portion of the Maumee River Watershed will have U.S. EPA approved 319 watershed management plans.
- Annually document that at least an additional 3.5 percent or 35,000 more cropland acres in WLEB are managed under nutrient management plans (NMPs).
- Maintain a minimum of 85 percent MAEAP reverification rate for farms in the WLEB
- Through MAEAP technical assistance:
 - a. Reduce additional sediment entering the waters in the WLEB by 50,000 tons per year;
 - b. Reduce additional P loading by 90,000 pounds per year; and
 - c. Reduce additional nitrogen (N) loading by 200,000 pound per year.
- Through MDEQ NPS program, add an additional 120 drain water management controls to reduce tile line discharges from 3,300 acres of cropland per year for three years.

Key Program Tactics

Success at the Lake Erie basin level will require collaboration with Ohio, New York, Pennsylvania, Indiana, Ontario, and the federal agencies in the U.S. and Canada. To that end, each jurisdiction will need to develop tactics and implementation strategies to reach their respective reduction goals.

GENERAL APPROACH

Michigan's tactics involve an overarching approach that will incorporate adaptive management at the regional and state level, and individual programmatic actions identified through each Department. The QOL agencies are committed to working together to address Lake Erie nutrient loading holistically in the WLEB.

Adaptive Management

To capitalize on learning from approaches, investments and new scientific information, Michigan will use an adaptive management approach to guide management decisions, actions and policy development.

Adaptive management requires both a structured framework and a process to implement (Figure 1). Active adaptive management begins with a set of goals that frame the desired management outcome and a list of knowns related to the information surrounding the issue. With active adaptive management, a plausible list of solutions or actions is developed that are intended to achieve the stated goal and measurable management actions are implemented. A

strong monitoring effort is required to track outcomes, frame uncertainty, and provide the basis for understanding progress.

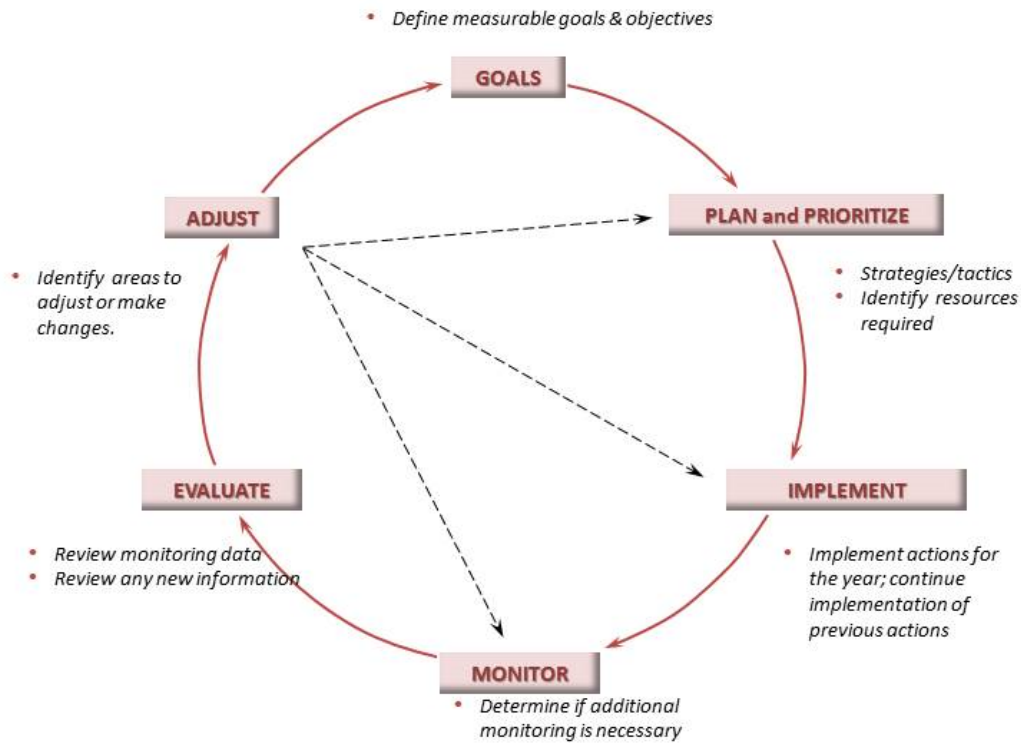


Figure 1. Adaptive management process for Michigan's Domestic Action Plan for Lake Erie.

Michigan plans to implement an active adaptive management process at two levels: the Lake Erie basin level and the Michigan-specific level. At the basin level, representatives of Michigan's QOL agencies will continue to participate on the Annex 4 subcommittee and its related task teams and work groups. These are interdisciplinary groups that integrate the policy perspectives and technical expertise of state and federal agencies' staff, academia, NGOs, and industry leaders. The combined purpose of these groups is to:

- Assess scientific information, models, and data related to addressing nutrient related problems in Lake Erie.
 - a. Addressing areas of uncertainty in the information, and
 - b. Providing input on how new information affects prior assumptions and management strategies
- Assess progress toward meeting Lake Erie basin-wide and sub-basin specific goals; and
- Identify recommended direction (or shifts in direction) for action and targeted areas for investment in research.

At the state level, the QOL agencies are also committed to annual review and evaluation of progress toward meeting Michigan-specific P reduction and ecosystem goals. Each agency will track its implementation of specified actions as appropriate for the actions identified in this DAP. On a periodic basis, the QOL agencies, with the input as appropriate of federal partners, academia, NGOs, industry stakeholders, and other stakeholders will evaluate the actions taken against trends in P concentrations and loads, and cyanobacteria blooms. Michigan is

considering options for the evaluation timing to be consistent with other states and federal partners. Based on the results of the annual evaluation (i.e., a feedback loop) the agencies will make adjustments in implementation strategies as needed to ensure Michigan's objectives are achieved.

In addition, the agencies will invest in applied research to help inform implementation success and direction. The QOL agencies are working in a partnership with United States Geological Survey (USGS) and Michigan State University (MSU) to implement drainage management research sites. As SRP has increased in the basin, the need for research to address what practices are effective at reducing loading is a high priority. Knowing the BMP's that will reduce SRP loading will allow for more effective, site specific BMP implementation to reduce all sources of phosphorus loading to the WLEB.

Biological Response

Time-lag is an important aspect to consider between the expected outcomes between management action and ecosystem results. For instance, numerous examples document the importance of time lag and the ability to measure an outcome of either a restoration activity or a detrimental introduction. The most well-known example in the Great Lakes is the long time lag between the beginning of the invasion of zebra and quagga mussels and their ultimate altering of the physical environment and water quality at a large scale which has been detrimental to native Unionids and the food web for native fishes. It will be important as the adaptive management plan is implemented to consider the amount of time between implementation of management or landscape actions and the expectation of measurable outcomes.

Strategically Targeted Watersheds

The parties to the GLWQA through the Annex 4 process determined the [Recommended Phosphorus Loading Targets](#) for Lake Erie in May 2015. The targets for priority watersheds were also established for Michigan under the Annex 4 process as detailed above. Consistent with the Annex 4 process, the QOL departments have focused on the mouth of the Detroit River (for all sources of flow to the upstream St. Clair-Detroit River System), the River Raisin Watershed, and Michigan's portion of the Maumee River Watershed (Figure 2). Because of focusing on these areas, it does not mean that the QOL departments will not implement P correction in other areas that drain to the WLEB. However, the total loads removed from other WLEB watersheds will be in addition to the loads removed in the priority watersheds.

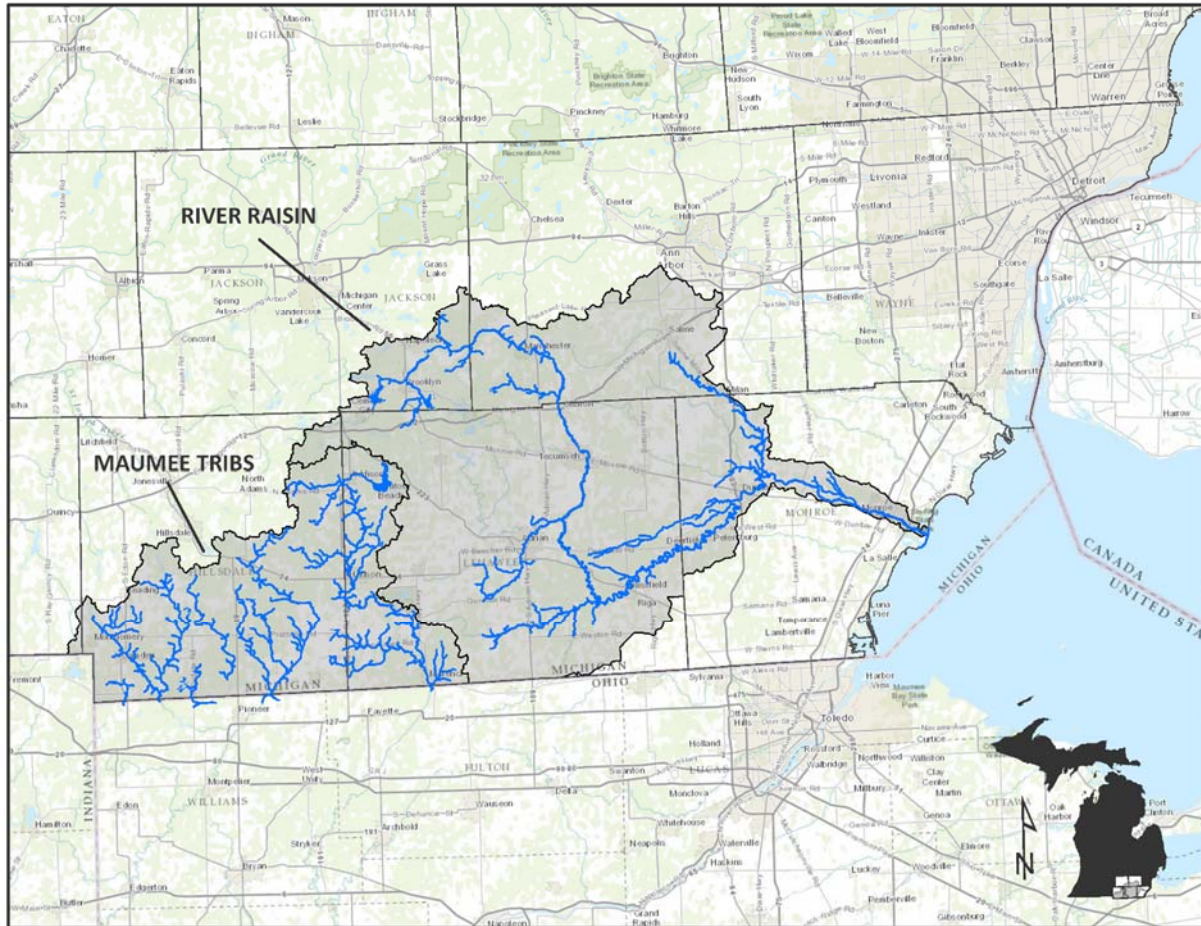


Figure 2. Michigan Priority Watersheds

Michigan Point Sources

Michigan has the unique situation where one WWTP dominates the overall flow discharged to the Detroit River, then to Lake Erie; the GLWA WRRF (formerly the Detroit Water and Sewerage Department WWTP). There are four WWTPs that will be addressed in this DAP. The four are the GLWA Detroit WRRF, the Wayne County Downriver WWTF, the YCUA WWTP, and the Monroe Metro WWTF. These four WWTPs discharge over 90 percent of the total P load from point sources to Lake Erie. Other WWTPs and lagoon systems that are tributary to Lake Erie are not being addressed in this plan because addressing each and every WWTP and lagoon system will not significantly affect the overall P load reduction to Lake Erie.

[The Michigan Biosolids Program](#) establishes standards for the land application and beneficial recycling of biosolids in the state. Any treatment works treating domestic sewage proposing to land apply biosolids in the state are required to prepare a Residuals Management Program Guidance Document to obtain authorization. This authorization is under an individual NPDES permit, a COC under a NPDES general permit, or a state issued Groundwater Discharge Permit.

[The Michigan CAFO Program](#) regulates CAFOs under an NPDES (individual or Certificate of Coverage [COC]) or applicable Groundwater Discharge Permit. The latest general permit ensures protection of all water resources, including: storage, comprehensive nutrient management plans, and other needed requirements. There are 17 CAFOs in Michigan's portion

of the WLEB. These CAFOs have been and will continue to be inspected for compliance with permit conditions. Permitted CAFOs in the state of Michigan, their NPDES permit requires them to have six months of available liquid manure storage by December 1st in any given year. Although not specifically denied the ability to land apply in the winter or on frozen ground, liquid manure application is generally not a common practice for these farms and requires DEQ notification.

Nonpoint Source Program

[Michigan's NPS Program](#) provides technical and financial support to stakeholders to develop and implement watershed management plans to restore and protect water quality. The NPS Program uses an adaptive management approach to find and fix the highest priority NPS sources of pollution and causes of impairments identified in approved watershed management plans. The NPS Program supports implementation of BMPs to reduce or eliminate pollutant loads from livestock and cropping operations in watersheds dominated by agricultural land uses. These practices include traditional activities such as livestock fencing and nutrient management plans as well as more innovative approaches such as drain water management controls to reduce SRP loads and the use of geographic information systems to target fertilizer application resulting in less fertilizer use without any loss in productivity. In urban watersheds, the priority actions often include Low Impact Development and Green Infrastructure BMPs intended to address storm water impacts. Failing onsite septic systems are linked to water quality impairments in some watersheds and the NPS Program supports efforts to find and fix failing systems as well as provide information to homeowners regarding proper septic system maintenance. The NPS Program also supports efforts to protect high quality waters through the implementation of conservation easements or ordinance development.

Wetland Restoration and Land Management

MDNR will continue to provide support and leadership for development of wetlands or conservation easements as a matter of fisheries and wildlife habitat conservation and development and for reduction of delivery of P into WLEB. Additionally, state facilities and land owned by MDNR will be reviewed to assess their status for potential contributions for P into WLEB and plans will be developed to address these sources.

Agriculture

There is not one single agricultural BMP for reducing TP and SRP loss in the WLEB. Research partners will continue to provide valuable input regarding the suite of recommended BMPs and their effectiveness on the landscape. This is especially true in regard to SRP and subsurface flow. Modeling and decision support mapping tools, such as the Great Lakes Watershed Management System and High Impact Targeting tool, identify at-risk fields based on soil types, slope and proximity to water. These tools then recommend management practices that reduce sediment and nutrient loading. Precision agriculture technologies such as grid sampling, variable rate application, and yield mapping can also identify acres that are candidates for a management change.

In order to make meaningful change to water quality, the approach on agricultural lands will use comprehensive conservation planning to identify site-specific management practices for individual fields. These BMPs will result in the greatest environmental benefit, while maintaining productivity. This will ensure that technical and financial assistance can be utilized most efficiently and effectively.

The Michigan Right to Farm Act, Public Act 93, was enacted in 1981 to provide farmers with nuisance protection. This state law authorizes the Michigan Commission of Agriculture and

Rural Development to develop and adopt [Generally Accepted Agricultural and Management Practices \(GAAMPs\)](#) for farms and farm operations in Michigan. These farm management practices are scientifically based and updated annually to utilize current technology promoting sound environmental stewardship on Michigan farms. The current list of practices, which are reviewed and updated annually, includes: Manure Management and Utilization, Nutrient Utilization, Irrigation Water Use, Pesticide Utilization and Pest Control, Site Selection, Care of Animals, Cranberry Production, and Farm Markets.

Michigan has historically provided the ability to conduct winter manure applications. The Michigan Right to Farm Manure Management and Utilization GAAMPs provide information on acceptable practices to reduce application risks. For farmers participating in the MAEAP, local technicians work directly with them, utilizing additional tools to assist farmers in the management of this practice. Specifically, technicians utilize a tool developed by the U.S. Department of Agriculture - Natural Resources Conservation Service (NRCS) called the [Manure Application Risk Index \(MARI\)](#). This tool looks at proximity to surface water, slope, cover, and tillage to assess the suitability for winter spreading. Technicians identify fields for farmers that minimize the likelihood of offsite movement of nutrients and pathogens.

In addition to the above, the MDARD and the MDEQ have worked together to develop a visual tool to assist farmers in lowering the risk of offsite manure nutrient movement. This is an educational tool titled “Winter Manure Spreading Risk Based Decision Making.” This tool is used in conjunction with MARI to help farmers evaluate the risk of their application decisions and guides them toward practices that reduce the risk of offsite movement of manure nutrients.

The primary tool for working with agriculture in the WLEB is the [Michigan Agriculture Environmental Assurance Program \(MAEAP\)](#). MAEAP is an innovative, proactive program that helps farms of all sizes and all commodities voluntarily minimize agricultural pollution risks. MAEAP was developed by a coalition of farmers, commodity groups, state and federal agencies, and conservation and environmental groups.

Interested farmers enter the program through participation in what is known as a MAEAP Phase 1 training event. These local and statewide events provide farmers with information on participation in MAEAP, as well as associated environmental and risk mitigation topics. The next step is working with a local conservation district (CD) MAEAP technician to conduct a confidential on-site risk assessment. Following the identification of potential environmental risks, farmers and MAEAP technicians work together to implement BMPs to mitigate those risks. Once a farmer has completed the conservation and management practices identified for environmental risk on their farm, they can request third party verification of environmental compliance by MDARD staff.

Farms can be verified in several “systems,” [Farmstead](#), [Cropping](#), [Livestock](#) or [Forest, Wetlands, and Habitat](#) corresponding to the risk assessment tools used by MAEAP technicians. The MAEAP systems’ committees establish verification standards for each system to keep up with the changes to laws and environmental standards, as well as address new issues that arise. If a farm is found to be in conformance with verification standards, they are verified in that MAEAP system. Provided the farm continues to meet MAEAP standards, verification is good for five years before reverification with MDARD is required. Standards are reviewed and updated annually by each stakeholder workgroup. The standards are then approved by the MAEAP Advisory Council and submitted to the Agriculture Commission for approval. At time of re-verification, the farm must meet current program standards.

ACTION AND CHANGE FROM 2008 THROUGH 2016

Michigan has been strategically aggressive in pursuing TP reductions since Lake Erie was first declared “dead” in the 1960s. In recent years, Michigan has continued to be proactive and successful in reducing loads to Lake Erie, but the work is not complete.

Point Source

Reductions in TP have been especially dramatic in the GLWA (formerly DWSD) P loadings. GLWA is by far the largest point source discharge to Lake Erie. The reductions in this discharge were the main reason the Lake Erie ecosystem rebounded the first time, and why Michigan continues to strategically focus on this discharge source. Michigan recently concentrated on the GLWA discharge in 2011 due to a confluence of events, including the large Lake Erie algae bloom, reissuance of the GLWA NPDES permit, and preparing for the end of federal court oversight after 33 years. These events pushed Michigan and GLWA to focus and implement additional P controls early in the process – a proactive approach.

Nonpoint Source Program

MDEQ continues to provide technical and financial support to stakeholders pursuing NPS nutrient and sediment reductions at the watershed level in the WLEB. Michigan offers financial support to implement approved watershed management plans for the River Raisin and Upper St. Joseph River (Michigan's portion of the Maumee River) watersheds through annual, statewide requests for grant proposals. In addition, Michigan's NPS Program is providing technical and financial support to develop watershed management plans for the LaPointe Drain and the Tiffin/Bean Watersheds (Figure 3 below). Michigan's portion of the Maumee River Watershed will be largely covered by approved watershed management plans after the Tiffin/Bean Watershed plan is approved. Examples of technical and financial support to implement approved watershed management plans includes funding for the installation of 485 tile line control structures that resulted in drain water management on 13,346 acres of cropland. Other examples include support provided to the City of Adrian to implement Green Infrastructure BMPs to control storm water inputs in the Raisin River Watershed. Permanent conservation easements were also purchased in the headwaters of the River Raisin Watershed to prevent sediment and nutrient inputs from high quality areas in the watershed. In addition, funding and technical support were provided to implement agricultural BMPs and matching funds for the Conservation Reserve Enhancement Program (CREP) and Regional Conservation Partnership Program (RCPP) in the WLEB.

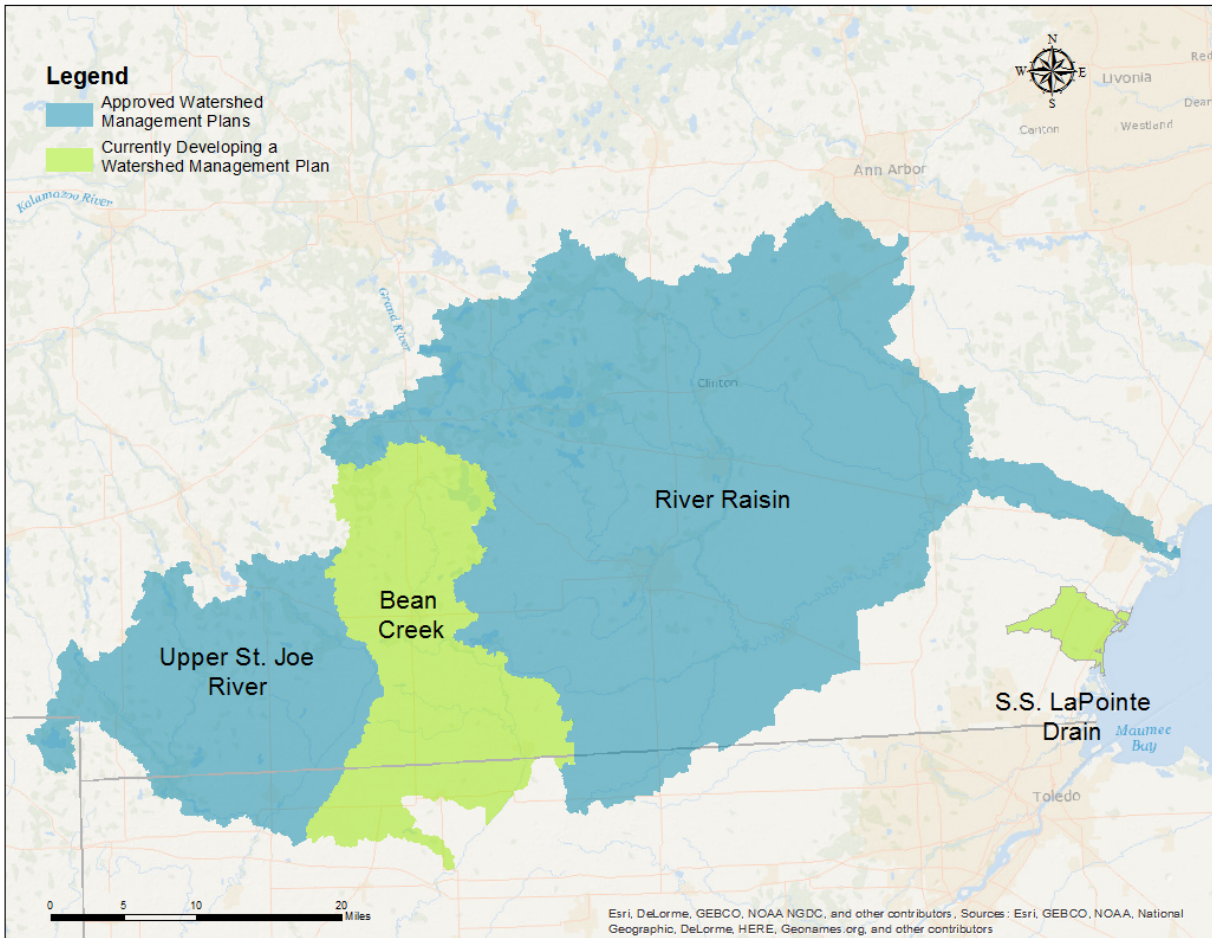


Figure 3. Approved watershed management plans in the WLEB and watershed management plans under development.

Michigan also implemented a statewide residential fertilizer P ban in 2012. Phosphorus fertilizer applications are restricted on residential and commercial lawns in Michigan, including athletic fields and golf courses statewide. This includes applications by both homeowners and commercial applicators. A more restrictive ban in 2006 in the city of Ann Arbor was shown to reduce P loadings in surface waters in residential areas by about 30 percent. This reduction may be used as a guide to estimate load reductions in residential areas in other watersheds. In addition, Michigan enacted a ban on P in dishwasher detergent that became effective in 2010. Phosphorus in laundry detergent as well as other soaps was banned decades earlier before automatic dishwashers were common. The 2010 action brought automatic dishwasher detergents in line with other soap products.

Wetland Restoration and Land Management

Wetland restoration and conservation easements along riparian areas can contribute significantly to restoring ecosystem function and providing for a reduction in phosphorous loading to the Western Lake Erie Basin. Since 2010, Michigan has partnered with Ohio and Ducks Unlimited on more than five regionally supported projects to restore wetland function and habitat for waterfowl and fish in the WLEB. This amounts to an investment of approximately \$5 million dollars for wetland restoration and fisheries and wildlife habitat. The amount of reduction

in loading that these efforts have contributed has not been calculated, but should be considered as part of the overall efforts to date.

Agriculture

From 2013-2016 MDARD secured funding to provide additional technical assistance, soil testing, and outreach to farmers in the WLEB. In 2015, MDARD created an internal plan to outline program goals and action steps and begin tracking progress specific to the WLEB.

Through MAEAP, MDARD is able to document the following environmental outcomes (Table 1). These agricultural practices provide the nutrient and sediment reductions every year for the lifetime of the practice.

Practice/Reduction	FY 15 Verifications	FY 16 Verifications	WLEB Three Year Sums
Acres of Conservation Tillage	19,155	20,573	77,120
Acres of Cover Crops	5,542	6,480	16,736
Acres of Nutrient Management Planning	38,737	36,862	135,651
Linear Feet Filter Strips	267,023	112,712	946,015
Total, tons/year Sediment Reduction	57,497	54,248	201,494
Total, lbs./year Phosphorus Reduction	94,607	96,432	337,191

Table 1. MAEAP WLEB FY 2013-2016 Accomplishments

In 2017, MAEAP initiated a new database to better track the cumulative impact of conservation practices across the watershed or county scale. In 2018-19, this database will be enhanced with spatial mapping that will enable technicians and farmers to target acres that are most vulnerable to sediment and nutrient loss.

The MDARD, MDEQ, MDNR, NRCS, USDA-Farm Service Agency, and CDs have been working as conservation partners to address nutrient and sediment losses that may result from agricultural land uses. Through this partnership, technical assistance and Farm Bill financial assistance programs have been offered to farmers in the WLEB.

The CREP has made 14 to 15-year agreements with farmers in the WLEB that cover nearly 23,000 acres with practices such as permanent grasses and legumes, permanent native grasses, field windbreaks, filter strips and riparian buffers, wetland restoration, and sediment retention control structures. Approximately a 65-75 percent reduction in P delivery and sedimentation has been realized on these acres, based on soil loss calculations before and after practice implementation, dependent on crop rotation and tillage practices.

MDARD is the lead agency for the Tristate Phosphorus Reduction Initiative RCPP Project (\$17.5 million total award), which will provide \$2.5 million in conservation practice funding for eligible Michigan farmers from FY 2015–FY 2019. In 2015-16, over \$584,000 was awarded to farmers in the Michigan area of the basin to install practices including: 12,119 acres of nutrient management, 20,702 acres of cover crops, and drainage water management structures that impact 1677 acres.

The [4R Nutrient Stewardship Certification Program](#) works with agricultural retailers, service providers, and other certified professionals to adopt proven best practices through the 4Rs (Right

Source of Nutrients at the Right Rate and Right Time in the Right Place). This approach provides a science-based framework for plant nutrition management and sustained crop production, while considering specific individual farms' needs. The 4R Program influences 1.9 million acres in the WLEB. MDARD supports the implementation and the continued growth and evolution of the 4R Program. Since 2015, three Michigan agriculture retailers have achieved 4R certification.

Load Reductions

In order to determine where Michigan is compared to the loads discharged in 2008, we need to evaluate our three key watersheds. Though we have made significant progress for the Detroit River and good progress for the Raisin River, we still have room to improve. The Detroit River reductions to date have been calculated using available monitoring data from the GLWA. Thus far, the Detroit River has achieved a 32 percent TP reduction. This reduction is mainly due to additional controls at the discharge points at the GLWA Detroit WRRF and its associated treated CSOs.

Reductions in the Raisin River Watershed (predominately agricultural land use) near the river mouth have been estimated using the available monitoring data by Heidelberg University, the United States Geological Survey (USGS), and accounting for loads from the Monroe WWTF. Using the 2008 baseline from the Annex 4 process of 262 MT and normalizing for flows, the QOL believes that there has been a 20 percent TP reduction since 2008. This reduction is for the annual reduction for TP, but the QOL believes that any trend in SRP is not yet discernible. In addition, spring TP and SRP loads have not yet been analyzed.

Michigan's portion of the Maumee River Watershed is relatively small, approximately 300,000 acres in size, which represents approximately seven percent of the land area in the watershed. Land use in Michigan's portion is mainly agriculture, including eight CAFOs under NPDES permit. These eight CAFOs use about 21,000 acres for land application of manure, representing seven percent of the Michigan portion of the Maumee River Watershed. Residential land use also represents about seven percent of the land use in the Michigan portion. There is one larger publicly-owned treatment works (POTW) - the Hudson POTW - that discharges to Bean Creek. Phosphorus load patterns from Michigan's portion of the Maumee River Watershed (i.e., Bean Creek and St. Joseph River) are not clear at this point and there is limited P monitoring data available for either tributary. The closest USGS gauge is on the Tiffin River in Ohio. Michigan initiated surface water monitoring in Michigan's portion of the Maumee tributaries in 2016. Results were used to inform development of a more detailed monitoring strategy for 2017 in an effort to better understand P contributions in this watershed.

Long Range Planning Initiatives

Released by the Michigan Office of the Great Lakes in 2016, the Michigan Water Strategy is a 30-year plan for Michiganders to protect, manage, and enhance Michigan's water resources for current and future generations. The Strategy identifies key actions for people and organizations at many levels to promote healthy water resources. One of Governor Snyder's five priorities outlined in the Strategy is to achieve a 40 percent P reduction in the WLEB by 2025 ([Michigan Office of the Great Lakes, 2016](#)). In addition to the very specific priority to reduce P loadings to the WLEB by 40 percent, the Water Strategy includes other recommendations relevant to the DAP, including: developing harmful algal toxin water quality criteria; a real-time monitoring strategy for Great Lakes drinking water intakes and public recreation locations within the St. Clair-Detroit River System; the development of a national drinking water advisory target; and, enhancing the ability of communities to facilitate and support community-based dialogue and water-related vision development. Work in these additional areas will strengthen water quality-

related policies, water-based stewardship, and improve water quality statewide.

The [21st Century Infrastructure Commission Report](#), published in November 2016, addresses Michigan's infrastructural needs for the next 30-50 years in a number of areas including water, sewer, stormwater, wastewater treatment, and drainage. Part of these targeted areas address water quality issues including: replacement of aging water, sewer, and stormwater infrastructure; regular assessments and maintenance of Michigan's drinking water, sewer, stormwater and dam infrastructure systems; development of integrated and sustainable approaches to manage the quantity and quality of stormwater, establish a statewide sanitary septic code and require septic inspections; and provide safe, affordable drinking water through public and private water supplies.

Success in Lake Erie

Michigan will engage the public in further development and implementation of the DAP through periodic public meetings and discussions with stakeholder groups. Because Michigan is using an adaptive management approach, this DAP may be updated in the future as new environmental and nutrient loading data become available and knowledge gaps related to SRP, the role of invasive mussels, and HABs are filled. Government agencies can provide the framework and select resources to achieve progress towards a better ecosystem in Lake Erie. Ultimately, success will be defined by action by all stakeholders in the Lake Erie basin.

APPENDIX 1. MICHIGAN WORK PLAN

#	Task	Who	Timelines/Milestone	Reporting
1	Maintain the phosphorus reductions achieved in the GLWA discharge due in part to the more stringent TP effluent limits placed in the NPDES permit in 2013.			
1a	TP limits of 0.7 mg/l monthly average, and 0.6 mg/l growing season average (April – Sept.), are required at the main secondary treated outfall at the WWTP.	MDEQ	Completed	MiWaters, through NPDES DMRs
1b	TP limits of 1.5 mg/l monthly average are required at the two wet weather outfalls at the WWTP.	MDEQ	Completed	MiWaters, through NPDES DMRs
1c	Monthly calls/meetings between MDEQ and GLWA to ensure compliance with effluent limits and to discuss any issues.	GLWA, MDEQ	Ongoing, monthly but reassessed annually for call frequency.	during calls
2	Achieve reductions in P discharged from the Wayne County Downriver WWTF, and continue reductions at YCUA WWTP.			
2a	Reissue NPDES permit with TP limits of 0.7 mg/l monthly average, and 0.6 mg/l growing season average (April – Sept.), at the secondary treated outfall at the WWTP.	MDEQ	Draft permit under negotiation, expect to reissue NPDES permit by 9/30/2017.	MiWaters will include the permit once reissued.
2b	More stringent TP limits required by permit schedule by 2020.	Wayne County, MDEQ	More stringent TP limits required by 2020	MiWaters, through NPDES DMRs
2c	Continue to achieve the TP 0.6 mg/l growing season average permit effluent limit at the tertiary treated outfall at the YCUA WWTP, as required in its NPDES permit.	YCUA, MDEQ	Completed	MiWaters, through NPDES DMRs
3	Identify priority areas in Michigan's portion of the Maumee River Watershed for P reductions. Identify and implement priority actions to reduce P loads from Michigan's portion of the Maumee River Watershed.			
3a	Develop and implement 2016 monitoring plan.	MDEQ	Completed	
3b	Develop and implement 2017 monitoring plan, including SRP, in coordination with Indiana and Ohio.	MDEQ	Monitoring began April 2017	
3c	Conduct additional monitoring as appropriate to evaluate P reduction success and identify additional target areas for reduction.	MDEQ	2017 and thereafter, as appropriate	

#	Task	Who	Timelines/Milestone	Reporting
3d	Develop watershed management plans for the Tiffin and Bean Watersheds. The Tiffin/Bean are the last Maumee River subwatersheds in Michigan without a U.S. EPA approved 319-plan.	MDEQ	Grant awarded to Hillsdale County to develop 319 plan. Target completion date is 1/31/2019	Target completion date is 1/31/2019
4	Support and invest in research to better understand the causes of HABs, including invasive mussels and SRP and how these factors increase/decrease HAB events.			
4a	Assess annually to understand information gained, and opportunities for additional research support. A better understanding on this topic is critical to refine our implementation program under the adaptive management approach as part of Annex 4.	MDEQ, MDARD, MDNR, and other federal, academic partners		
4c	Implement 2 HAB related research grants: Detection of toxin-producing blue-green algae (Grand Valley State University); development of HAB hazard maps using land use and toxin data, and development of smartphone app to detect HABs (Oakland University with Wayne State University, Lake Superior State University, and Northern Kentucky).	MDEQ, academic partners	MDEQ awarded grants in 2016	
4d	Conduct Zequanox pilots as needed.	MDEQ, Marone Labs, aquatic nuisance pesticide applicator	Pilot completed in 2014, annually assess for opportunities.	
4e	Participate in the Invasive Mussel Collaborative.	MDEQ, interested partners	ongoing	

#	Task	Who	Timelines/Milestone	Reporting
4f	To further understand SRP, including agreement on appropriate sampling and analytical methods, participate in Annex 4 discussion, develop relationships, attend regional conferences, and partner with federal, state, and local monitoring efforts.	MDARD, MSUE, MDEQ; Annex 4 Targets and Objectives Task Team	Ongoing	
4g	Design and fund a study to evaluate SRP discharge quality as a function of level of municipal treatment; secondary treated, primary treated, CSO Retention Treatment Basins, and untreated CSOs.	MDEQ and future partner	2017	
5	Utilize research and field demonstrations to identify the suite of BMPs that work collectively to reduce both TP and SRP at the field implementation level.			
5a	Implement new MAEAP reporting and planning database to better track the cumulative impact of conservation practices across the watershed or county scale.	MDARD	Started October 1, 2016. Environmental and conservation practice information will also be used to estimate sediment and nutrient loading reductions.	MDARD Annual Report and MAEAP Database
5b	Expand MAEAP database through the addition of a spatial mapping decision based tool to enable technicians to demonstrate to farmers sensitive areas that are conducive to BMP installation.	MDARD	FY 17 creation of spatial mapping decision based tool.	MDARD Annual Report and MAEAP Legislative report
5c	Implement spatial mapping decision based tool upgrades to database with MAEAP technicians.	MDARD	FY 18 roll-out to MAEAP technicians.	MDARD Annual Report and MAEAP Legislative report
5d	Continue to seek new data and information about BMPs and monitoring strategies through ongoing communications with research universities and federal agencies such as the USGS, U.S. Army Corps of Engineers, and USDA Agricultural Research Service	MDARD	MDARD Environmental Stewardship Division staff annually identify and review research and conference opportunities. Discuss at MAEAP staff meetings.	

#	Task	Who	Timelines/Milestone	Reporting
5e	Work with partners to design and implement a study to evaluate the effectiveness of drain water management control practices installed to reduce tile line discharges of SRP.	MDARD, MDEQ, USGS	To be determined.	Ongoing
5f	Utilize use pass-through grants to reduce sediment and nutrient loads from the WLEB by implementing priority BMPs from approved watershed management plans.	MDEQ NPS Program and stakeholders	The NPS Program's pass-through grant request for proposals is issued annually.	Ongoing.
6	Implement P control actions in the River Raisin Watershed to achieve the target load reductions.			
6a	Conduct forensic analysis to determine likely sources resulting in reductions.	MDEQ	Completed February 2016.	Post report on DEQ website
6b	Reissue the Monroe Metro WWTF permit with more stringent TP limits of 0.7 mg/l monthly average, and 0.6 mg/l growing season average (April - Sep), at the main secondary treated outfall at the WWTF.	MDEQ	Completed April 2016; revised TP limits required by 2019.	MiWaters includes the reissued permit.
6c	Continue to use pass-through grants to place an emphasis on a targeted and comprehensive approach to farm conservation planning, livestock management strategies, and drainage water management strategies.	MDEQ NPS Program and watershed stakeholders	The NPS Program will release a request for proposals annually.	Ongoing
7	Maintain and expand partnerships to provide valuable technical and financial assistance to farmers. Continue expanded CD MAEAP technical assistance levels through 2017 and beyond.			
7a	Seek additional funding to assure the ongoing expanded levels of local MAEAP technicians in the WLEB.	MDARD	For 2017 and each subsequent year, maintain technicians in the WLEB. Annually review the technical assistance need to expand, reduce, or target efforts.	MDARD Annual Report

#	Task	Who	Timelines/Milestone	Reporting
7b	Strengthen partnerships with the agricultural community, including farming input providers and Certified Crop Advisors through the 4R Nutrient Stewardship Program, to encourage more farmers to take action to protect water quality.	MDARD and partners	FY 17-19 Partner on the Farmer-Led Conservation effort to encourage grass roots farmer involvement in education, cost-share and decision-making. FY 17 promote CCA incentive program to strengthen partnerships.	MDARD Annual Report
7c	Partner with USDA NRCS, Michigan State University Extension, and other partners to offer training to MAEAP technicians.	MDARD and partners	Annually train staff in risk assessment tools, nutrient management, manure management system plans, knowledge of BMPs, communications, and landowner outreach.	MDARD Annual Report
7d	Coordinate partnerships through quarterly WLEB Team meetings to review technical assistance and resources available to farmers.	MDARD, CDs, NRCS, MDEQ	Host four per year. Debrief on local efforts to review who is doing what, success stories, and obstacles.	MDARD Annual Report
7e	Partner to identify and secure additional funding and cost share to provide opportunities to farmers.	MDARD and partners	Seek additional partnership opportunities to provide technical and financial conservation assistance.	MDARD Annual Report
7f	Continue to use pass-through grants that place an emphasis on a targeted and comprehensive approach to farm conservation planning; livestock management strategies; and drainage water management strategies.	MDEQ NPS Programs and watershed stakeholders	The NPS Program will release a request for proposals annually.	Ongoing
8	Increase and maintain MAEAP practice implementation for long term water quality improvement.			
8a	Identify and implement more incentives to expand participation in MAEAP through the MAEAP Advisory Council (AC).	MAEAP AC, MDARD	Incentive survey completed in 2016 with four recommendations submitted to MAEAP Advisory Committee and MDARD. FY 18-19. MDARD will pursue incentives identified and approved by the MAEAP AC incentives workgroup to increase program participation.	Evaluate incentives and pilot projects annually
8b	Increase MAEAP cropland acres managed under NMPs	MDARD, CDs	In FY 18, increase total MAEAP NMP acreage on farms by 35,000 annually.	MDARD Annual Report

#	Task	Who	Timelines/Milestone	Reporting
8c	Identify number of farms eligible for reverification and discuss during local MAEAP goal-setting meetings.	MDARD, CDs	Maintain a minimum of 85 percent reverification rate for farms in the WLEB.	MDARD Annual Report and local goal setting
8d	MAEAP technicians work one-on-one with farmers to provide technical assistance and identify environmental risks and recommend and prioritize BMP installation.	MDARD, CDs	Track number of risk assessments, BMPS installed, and acreage impacted.	MDARD Annual Report and MAEAP Database
8e	Increase farmers participating in MAEAP and track the environmental gains on both verified and non-verified farms.	MDARD, CD's	Increase number of program participants to 120 percent of FY 17 level. Track pounds of sediment, N, and P reduced.	MDARD Annual Report and MAEAP Database
9	Improve and increase outreach to the public and farmers to promote understanding of the basin and good conservation practices by initiating new targeted outreach campaigns, workshops, field demonstrations and information sharing.			
9a	Work with the MAEAP Communications work group committee and partners to conduct targeted outreach to public and farmers to raise the awareness of the benefits of MAEAP.	MDARD	MAEAP Communications work-group meets six times a year and will annually review short and long term communication goals. FY 17-19 MDARD partner with Farmer-led conservation effort on targeted outreach analysis and campaign in WLEB.	MDARD Annual Report Communications committee reports to MAEAP AC
9b	Host six conservation sails in FY 2017 to help farmers experience the impact of land management decision on the waters of Lake Erie first hand through water sampling and educational presentations.	Lenawee CD and partners	Annually review attendance and impact of education to determine ongoing efforts.	MDARD Annual Report
9c	Coordinate with partners to host on-farm field days, MAEAP Phase 1 educational events.	MDARD, CD's, MSUE, partners	Annually review attendance and impact of education to determine ongoing efforts.	MDARD Annual Report and MAEAP Database

#	Task	Who	Timelines/Milestone	Reporting
10	Promote wetland restoration and land management to reduce P loading.			
10a	Working with state agencies, tribal governments and stakeholders to develop innovative strategies to enhance wetland restoration and green infrastructure efforts in Michigan	MDEQ, MDNR, MDARD, LUGs, NGOs	To be accomplished by 2018.	Water Strategy implementation reporting
10b	Work with agency staff to review BMPs implemented on state managed lands in the WLEB.	MDNR	2018	Ongoing
10c	Work with partners to pursue strategic conservation easements in coastal wetlands, riparian zones, and key wetland areas to improve groundwater infiltration, reduce runoff, and support diverse aquatic and terrestrial biota.	MDNR and partners	External and internal funding programs can be sources of support such as DNR Fisheries Habitat Grants and Wildlife Habitat Grants and USFWS Great Lakes Fish and Wildlife Restoration Act Grants	Ongoing
10d	Issue requests for proposals that place a priority on purchasing conservation easements to limit land use activities that are detrimental to water quality.	MDEQ NPS Program and stakeholders	The NPS Program's pass-through grant request for proposals is issued annually.	Ongoing

Acronyms

AC – Advisory Council
BMPs – Best Management Practices
CAFOs – Concentrated Animal Feeding Operations
CCA – Certified Crop Advisor
CD – Conservation District
COC – Certificate of Coverage
CSO – Combined Sewer Overflow
CREP – Conservation Reserve Enhancement Program
DAP – Domestic Action Plan
DWSD – Detroit Water and Sewerage Department
DWTF – Downriver Wastewater Treatment Facility
HABs – Harmful Algal Blooms
LUG – Local Unit of Government
GAAMPs – Generally Accepted Agricultural and Management Practices
GLWA – Great Lakes Water Authority
GLWQA – Canada-U.S. Great Lakes Water Quality Agreement, 2012
MAEAP – Michigan Agriculture Environmental Assurance Program
MDARD – Michigan Department of Agriculture and Rural Development
MDEQ – Michigan Department of Environmental Quality
MDNR – Michigan Department of Natural Resources
MSUE – Michigan State University Extension
NGOs – Non-Government Organizations
NMP – Nutrient Management Plan
NPDES – National Pollution Discharge Elimination System
NPDES DMR - National Pollution Discharge Elimination System Discharge Monitoring Reports
NPS – Non-Point Source
NRCS – Natural Resources Conservation Service
RCPP – Regional Conservation Partnership Program
SRP – Soluble Reactive Phosphorus, also known as Dissolved Reactive Phosphorus
TP – Total Phosphorus
USGS – United States Geological Survey
WLEB – Western Lake Erie Basin
WWTP – Wastewater Treatment Plant
WWTF – Wastewater Treatment Facility
WRRF – Wastewater Resource Recovery Facility
YCUA – Ypsilanti Community Utility Authority